

ST

378.748
POP1893.2

UNIVERSITY
PENNSYLVANIA
LIBRARIES



A Statistical Study in Experimental Aesthetics:

A Thesis for the Degree of Doctor of Philosophy.

by

Caspar Wistar Miller, Ph. B.

378.748
POP1893.2

UNIVERSITY
OF
PENNSYLVANIA
LIBRARIES

A STATISTICAL STUDY IN EXPERIMENTAL AESTHETICS.

Since the aesthetic value of the objects surrounding us must always be more or less influenced by their various practical applications or associated ideas, it might with propriety be asked whether results obtained under conditions which more or less perfectly eliminate all such conscious associations can be used as data from which to derive laws governing the practical relations which must subsist as a basis for our aesthetic pleasure, - whether, in effect, the experimental aesthetics of the modern Germans is really the first step towards a scientific investigation of the Laws of the Beautiful or whether it is to be regarded simply as a branch of Psychology having no connection with the aesthetics studied by the Philosopher from the metaphysical standpoint, or the Artist and Musician empirically.

While not disposed to admit the force of this objection, a discussion of it is beyond the scope of the present paper, and it will here simply be assumed that the existence of Experimental Psychology is in itself a sufficient excuse at least for an attempt to throw light on some of its phases which have not so far been accorded the attention which their interesting character would seem to warrant.

As the work of the principal investigators in this field, Zeising and Fechner, has been necessarily kept constantly in mind during the present experiments, it may be well before describing the latter to recall briefly the more important features of the earlier German work.

In the middle of the present century an elaborate attempt was made by Zeising to ~~form~~^{and} a fundamental law of aesthetics. -The idea of the beautiful is so intimately connected with that of "Proportionality" that any clear separation of the two is impossible. Now in the universe as we find it all dimensional relations are so ordered as to be capable of resolution into a certain mathematical ratio. But since the world is posited as the Absolutely-beautiful, it appears that this math^{ma}thetical ratio also represents the most fundamental law of the aesthetic of compounded dimensions, and from the commonly recognized principle of aesthetics we may suppose from this that it represents most perfectly the idea of the manifold in the one: to ~~it~~, Zeising has given the name of the "Fundamental Morphological Law of the Universe". The ratio to which Zeising attaches ~~so much~~^{such} importance is that known as the "Golden Section", or Harmonic Mean, -such that the lesser of two quantities is to the greater as the greater is to the sum of the two, or (if we put one equal the smaller dimension,

x equal the larger) then $I : x = x : I+x$, from which the quadratic equation $x^2 - x - I = 0$. Solution gives a value $x = 1.61803$

The chief merits which Zeising attached to this proportion and which *led* him to believe it more advantageous than any other are: 1. From its irrationality it combines the endless with the practically realizable. 2. It is in a certain sense both a geometrical and an arithmetical proportion since one of its members is also the sum of the other two, which condition establishes an equality and continuity of the relations between the whole and its parts, and so corresponds most closely to the general notion of proportionality, in which we look for an agreement of on the one hand the ratio in which the parts stand to each other and on the other hand to the whole. 3. The mean between perfect unity and too great diversity of the parts represents also the most natural transition from unity to multiplicity. Zeising believed this relation to extend not only to the order of things on the earth but also to the distances of the planets and star groups, supporting this view by an enormous number of detailed measurements, from which scarcely anything known to modern science appears to have escaped. Various animals, including man, plant anatomy both gross and microscopic, the various forms of crystals, and finally numerous

works of art, ancient and modern, of recognized value,- all have been carefully measured and all are according to Zeising, but so many confirmations of his thesis*.

Fechner has more recently devoted attention to the further investigation of the comparative value of various dimensional relations, and although it can hardly be conceded that he has established any very satisfactory conclusions, he has at least placed the entire subject on a more intelligible basis. The following objections to Zeising's ^{work} furnished the incentive to Fechner's more careful study.

- I. Too much dependence was placed upon the general theoretical considerations, which were insufficiently supported by evidence.
2. Not enough care was taken to distinguish between pleasingness from association and direct pleasingness of form.
3. Only such cases are recorded as agree with the requirements of the theory, particularly is this true in the case of complicated works of art and the human body, which leave it an open question which are to be considered the chief dimensions.
4. Although capable of yielding the best results, experimentation under the simplest possible conditions was

* Proportionslehre, Leipzig, 1854.

neglected.* In his studies Fechner adopted three methods: Method of Choice, Method of Production, Method of Application or Employment. In the Method of Choice simple figures of different proportions are shown to a number of persons, each of whom selects that figure which pleases him most. In the Method of Production the subjects instead of selecting from figures already drawn, themselves construct the figures of the shape most pleasing.^{shape} In the Method of Application, simple objects whose use is purely or largely ornamental, and whose shape is accordingly determined by the necessity of making them as pleasing as possible, are measured, and the comparative aesthetic value of the different shapes is supposed to be represented by the relative frequency of their occurrence. Among other things Fechner measured Christmas cards and note paper envelopes. The results which Fechner has published and which are based chiefly on the Method of Choice, lead him to the following statements:^{*2}

I. The square, with the shapes near it, and the very long figures are the least pleasing.

* Vorschule der Aesthetik, Leipzig, 1876, p 186.

*² Vorschule der Aesthetik, pp 191-192.

2. The square has little advantage over the figures near it.

3. Simple rational relations, such as represent the relations in musical consonance have no advantage over relations which would produce dissonance.

4. The rectangle representing most nearly the golden section, together with the figures lying near it, are found to be the most pleasing.

5. In horizontal lines the symmetrical arrangement is much more pleasing than the harmonic division.

Fechner finally concludes that while the harmonic mean is really a pleasing mode of division, Zeising's elaborate claims for it are quite without foundation.

Unfortunately the results of neither of these investigators can be regarded as conclusive. Against the work of Zeising the objections of Fechner are perfectly valid; indeed it may well be questioned whether in a matter so purely psychological as the superior aesthetic value of one proportion over another any apriori argument can safely be allowed, - whether the only safe plan is not rather to first exhaust every means at our disposal to ascertain empirically the facts, whatever they may be, before venturing any final explanation

of them. Zeising's pre-conceived notion of an "Uridee" must in itself have had a considerable tendency to render his work less critical than it otherwise would have been, and his method of measuring from what in most cases appeared to be purely arbitrary points precludes the placing of any confidence in the one method which he employed to substantiate his wide-reaching hypothesis.

Fechner's work we should expect to find free at least from the defects which he justly points out in that of his predecessor, but in this we shall be disappointed. Of Fechner's three methods the first is the only one not open to serious inherent defects. In the Method of Application Fechner tells us that "One measures the simplest objects of ordinary life whose shape is determined rather with regard to pleasingness than use (provided that it is a question of pure, direct pleasingness)", without, however, indicating where such objects whose shape is free from use or association can be found, and the objects which he mentions are certainly very far from complying with these conditions. As our Author himself points out, visiting cards are appreciably modified by the length of the name they bear; envelopes vary much according to the fashion (which is no less true of

visiting cards). Fechner believes that they vary about an average size, this average representing the most pleasing form; but it is highly probable that this mean size is itself determined by practical considerations such as folding the paper once or twice, or often by the desire to preserve an agreeable relation to the address as written on the face of the envelop,- exemplified by the squarer shape of the average size in Germany, where the use of long titles causes the address to contain more lines than in the less ceremonious English speaking countries. Another class of objects which Fechner mentions comprises ornamental crosses in the form of jewelry. Of such crosses Fechner measured a large number, and concludes, since their use is for ornament, that they are essentially independent of the crucifix. This view cannot be regarded as satisfactory. The persons who buy crosses are for the most part those who have considerable religious association with them and are accustomed to see them in churches, or at least on cards, copies of paintings, etc., so that it seems hardly probable that the choice of shapes would escape the influence by association of the conventional crosses frequently seen. In his Christmas or "Glückwünschungskarten" Fechner has perhaps the best objects for his investigation, but even here he would have to

show that the size of the card was first determined upon, and then the verse, picture or other inscription made to fit it before he could legitimately depend upon such measurement. Since the inscription itself is the very excuse for the existence of the card it seems much more probable that the design would first be fixed and the card so cut as to make a suitable margin: this is essentially what the artist does when he selects a canvass of the proper size for his contemplated picture rather than paints until he has covered a certain surface.

The Method of Production is, curiously enough, regarded by Fechner as a distinct ~~feature~~ procedure from the Method of Choice, and it is even suggested that the results obtained by the latter be in part controlled by those of the former. The manner in which the method was employed was as follows: "In the case of crosses by this method a movable cross-piece is shoved along over a fixed upright until the most pleasing height appears to be reached" Now it is evident that in order to fix upon one height as the most pleasing we must have other less pleasing heights with which to make a comparison. Since, however, in moving the cross piece along we can see only one position at a time, we must depend on memory for the preceding or

comparison positions. The Method of Production is in fact nothing more than a modification of the Method of Choice in which the clearly drawn comparison figures are replaced by the more or less imperfect and confused memory images. Not only are such memory images far less reliable than the actual figures, but the effort quickly to observe and remember each shape so distracts the attention of the subject, that, at least in my own case, it is difficult to make a positive estimate of the value of any position, even before it has passed from view. Both this and the Method of Application appear to be so untrustworthy that in the present experiments they have both been discarded and the Method of Choice alone employed. Depending upon this method alone it becomes necessary to enter upon a somewhat fuller discussion of its disadvantages or merits than in the case of the other methods.

As defects^{*} in the method Fechner regards the following:

a) In order to get a sufficiently large number of results, it is desirable to experiment before audiences rather than with single individuals. But this manner of working is open to the defect that the expressed opinions of one subject are likely to influence the

* Zur Experimentalen Aesthetik, Leipzig, 1871. Erster Theil.V.

judgment of another.

b) When ready-constructed figures are shown to a subject it is impossible to have the series infinite, that is, with infinitesimal differences between the figures, the effect of this being that it might happen that the shape most pleasing to the subject might lie between two sizes actually shown him, and not be represented at all.

c) When we lay a limited number of figures before the subject it is possible that all may be smaller or all larger than the ratio which is for him the most pleasing. When this is actually the case the subject should choose one of the end figures,- the smallest, if all the figures drawn are larger than the most pleasing, the largest if all the figures drawn are smaller than the most pleasing. A figure at the end of the line is, however, from the very fact of its position, ^{at} a disadvantage compared with one nearer the middle, and it is possible that the subject would instead of selecting the end figure of the last line prefer one of the middle figures of that line. So strong is this tendency that even if the most pleasing ratio itself were an end figure of a line it is probable that one of the intrinsically less pleasing ^{middle} ~~end~~ figures would often be chosen. Fechner calls this disturbing action of the position of a figure the

"Influence of the Middle." As applied against the experiments of Fechner these objections are apparently valid enough, but there seems no reason why the first two cannot be easily avoided, while the third is of less importance that would appear from our Author's remarks.

a) The simplest way to correct this defect is to request the audience to write down their several opinions, cautioning them not to consult with each other but rather to make perfectly independent judgments. This was the plan which I habitually followed, but where the subjects were unable to do this intelligibly ~~intelligently~~ I first explained to them altogether and then questioned each separately, writing down his ^{own} ~~in~~ference as he himself would have done had he been able.

b) The possibility of the best shape falling between two of the figures shown, can be excluded by making the figures of so little difference between any adjacent two that the subject is only just able to distinguish between them. After several trials of different proportions, I settled upon those in which the figures were afterwards constructed as fulfilling this condition as nearly as possible without altering the absolute difference at different parts of the series.

At no part except the extreme lower end is the difference more than a very little over the minimum observable, and the series have a range such that but a small part of choices fall on this region; it is probable also that those who choose the extreme do so rather because they find considerable contrasts pleasing than because a figure of that particular shape is more pleasing to them than another whose proportions are but little different. It is true that in the case of the "Lines divided by a Point" (series 3) a large number of the choices fall at the ends, but in this series the opportunities of making accurate comparisons are from the arrangement of the figures so slight that for ordinary observation the effect throughout the entire series is that of a perfectly even gradation.

c) The "Influence of the Middle" does without doubt make itself felt. In some trials made by Fechner of placing before the subject three objects, the middle one was found from its position to have an advantage over the ends. This arrangement was, however, particularly adapted to bring out any such influence, and under the conditions of actual experimentation the results are by no means so regularly affected. In my experiments the rows were all composed of an even number of figures, and the number of rows is itself always even, so

that any exactly middle line or figure is excluded. Nevertheless even this arrangement is insufficient to prevent a majority of the choices from falling on the more central of the figures, in preference to those at the extremities of the lines. Since however the number of figures used in these experiments is so much greater than in those of Fechner, it will be seen that although the distraction of choices from the ends is really to be observed, it is of comparatively little importance, a distraction of a choice from the end of the line to the third figure representing in, for example, the case of the rectangles a difference of height of 4 mm., where the base is constantly 100 mm. While admitting, therefore, the reality of Fechner's objection of the "Influence of the Middle", I believe that it is not a nature ~~to~~ seriously^{to} prejudice the results in a series of experiments with a considerable number of suitably arranged figures.

Having now briefly reviewed the objections to which Fechner calls attention against the Method of Choice, certain defects in the actual manner of working of our Author which he apparently failed to detect, will next be pointed out. Describing his experiments he says^{*}:

Ten rectangles cut out of white cardboard were laid on a black table,

* Vorschule der Aesthetik. pp 193-194.

always without definite arrangement, and placed at various angles to each other. The rectangles were all of equal area (= a square with sides of 80 mm.), but of different proportions, the shortest being a square of the ratio 1:1, the longest with a ratio 2;5

To this plan the following objections can be made:

a) It is much less convenient than having all the figures fastened together.

b) By the frequent handling to which the figures must be subjected they are very apt to get dirty or have their edges more or less roughened, either of which would make a figure in which it occurred less pleasing. It is true Fechner says when this happens the entire series must be replaced, but in practice this is hardly likely to be done as often as it should be to avoid all risk of prejudice from this source.

c) Laying white figures on a black background exposes them to the effect of irradiation.

d) Placing them at various angles to each other is bad since the particular angle at which a figure is placed may easily influence the subject either in favor of ~~the figure~~ or against it. When a figure is at a considerable angle with the line of vision of the observer

he must either see it as a trapezium or else turn his head into a new and perhaps uncomfortable position, a fact which we would certainly expect to find influencing the feeling-tone. Finally, such a method is in any case better adopted to a series of experiments like Fechner's where only two classes are differentiated, male and female, than to one like the present, where it is specially desired to compare the results from a number of different classes, which is only practicable if the conditions be kept as nearly as possible alike for all the trials.

e) It is less advantageous to construct the figures of a constant area than it is to keep one of the sides a constant length. In both cases we have two variables, but ^{since} the the attention of the subject is to be concentrated on the two sides, judging the best proportion between them, we should allow only one of these to vary, the other variable thus becoming the area. Since the subject is always told to consider the shape only without regard to the size, the area is a matter of minor importance; moreover, the fact that the area remains constant, as it Fechner's figures, can be of little subjective value since one is unable to tell by simple inspection of a series of figures of varying shape that their several areas are all

equal, even if this be the case.

f) It is better to have the figures hung up in a vertical plane opposite the eyes of the subject than to spread them out on a flat surface, distortions of perspective or framing effects due to the boundaries of the supporting surface being more likely to occur when the latter arrangement is adopted.

g) The number of figures used was much too small, making the experiments especially liable to the defect which Fechner mentions, that the subject's choice may fall between two of the figures shown.

h) The series should not begin at the square but rather at a figure higher than long. It is very possible that if the subject notices that the first figure is probably a square he may be led to think it has on that account a special value, the supposition on his part being that something must have influenced the experimenter to have commenced at that particular figure rather than some other. It is true that since the subject is told to pick out the most pleasing figure on its own merits only, such ulterior considerations should not influence him, but practically it is difficult to get untrained observers to adhere strictly to this injunction, and we should try to remove every possible distracting influence. Closely related to

17

this is another possible source of error. Owing to the physiological overestimation of the vertical height of rectangular figures, a figure which is really a square appears higher than long. Now when a subject finds the square the most pleasing and attempts to pick it out, what he really does is to indicate a figure somewhat longer than high. It is no doubt this influence to which we must attribute Fechner's conclusion that the square is one of the most unpleasing figures. He himself quotes a case^{*} in which the subject thought that the square (first figure of the series) ought to be the most pleasing, but could not bring himself to regard it as such. We might be led to believe that if the square were really a pleasing figure, the next of Fechner's ratios, 5:6, ought to appear as the square and consequently receive a large number of choices. As a matter of fact, however, this figure is too far from the square to appear as such. The ratio commonly mistaken for 100:100 is 92:100 (see later), while 5:6 is approximately 83:100. But the figure objectively of this proportion is, as my experiments show, one of the least pleasing, so that we should not be surprised at finding that Fechner obtained only 0.22% of choices for his second figure. Had he constructed his

* Op. cit. pg 198.

his figures with a much less interval between adjacent members of the series he would probably have been led to a different conclusion in regard to the pleasingness of the square.

In the face of the foregoing imperfections it will probably be conceded that the conclusions of Fechner, not less than those of Zeising, stand in need of further substantiation before they can be regarded as authoritative expression of the facts of the case. The objects of the present study are, therefore, -

1) To confirm or disprove by means of experiment greater in number and more cautiously carried out than Fechner's the conclusions of the latter investigator.

2) If it be found that there is one proportion of greater pleasingness than the others, to ascertain if it remains constant in the different classes of subjects tried, and if not to examine the direction, extent, and significance of the variations.

It still remains before presenting the results to describe the practical details of the work.

Figures employed. In the construction of the figures an effort was made to avoid the defects already discussed of Fechner's series.

The means taken to attain this end follow, the letters referring to the

the list of objections to Fechner's work.

a) The figures are all on one piece of muslin.

b) The above arrangement obviates the necessity of handling the individual figures at all.

c) Figures are all drawn in outline.

d) Figures are all firmly pasted in the same position.

e) In each of the first two series one of the dimensions remains constant.

f) Figures arranged so as conveniently to admit of hanging them up.

g) The number of figures was made empirically sufficient.

h) In the series of rectangles the first three figures are all higher than long. In the crosses such an arrangement is unnecessary, for a cross in which the vertical is the same length as the horizontal gives the effect of having the former much longer than it really is.

While the Harmonic Mean is in none of the series exactly represented, the figures marked 0 are in each instance well within the limits of distinguishability from the figure representing exactly that ratio. For more detailed descriptions and reproductions of the figures see Appendix.

Method of Employing the Figures. The first series was pinned up and the subjects asked to select the figure which they preferred, the selection to depend entirely upon which proportion looked the most agreeable without any regard to any possible associations or mathematical relations existing between the sides. They were also cautioned not to communicate with each other. Blanks (see Appendix) were then furnished them on which to enter their preferences, in each case a first and a second choice being asked for. After they had all written their choices, the second series was pinned up, and the first and second choice asked and written. This was followed by the third series, from which figures were selected in the same manner. The subjects were then asked to fill in the blank lines on the left side of the form, stating: Sex, Age, Profession or business, If they were specially interested in Art, and if they had ever taken lessons in drawing. As has already been stated, if they were unable to fill in the blanks themselves I asked the appropriate questions of each separately and myself filled in corresponding blanks. At the end of each experiment the blanks were all numbered in regular succession with those which I had already gotten from previous experiments, the number of any particular blank in one series of experiments being,

however, purely arbitrary. The experiments with the inmates of the Philadelphia Alms House, those with whom the pupils at the Carlisle Indian School, and some of those at the House of Refuge, were not carried further than the rectangles, the crosses and divided lines not being used partly because of the difficulty of keeping the attention of these persons fixed long enough to permit any satisfactory result being obtained with more than one series of figures, and partly because the superior aesthetic value of one rectangle over another is much better marked than in the case of the other figures.

The tabulated results of the experiments follow:

DIAGRAM SHOWING ARRANGEMENT OF THE TABULATED RESULTS
OF THE EXPERIMENTS WITH RECTANGLES.

:::~::~:

Totals. I	
:	
2. Educated -----	:-----Uneducated 3
:	
4. Male -----	:-----Female.5
:	:
:	:--Art Students.I4
:	:--Grammer school.I5
:	:
:--Professional men.8	:--Indians.I6
:--Teachers and post-graduates.9	:--Paupers.I7
:--Undergraduates,U.of P. IO	:--House of Refuge.I8
:--Episcopal Academy.II	
:--Art students.I2	
:--Grammar school.I3	

The numbers affixed to the various classes above refer to corresponding numbers of the tables following.

Table No. 1 Rectangles.

Total Choices on Rectangles. 731

Ratios	1 st Choice	2 nd Choice	Ratios	1 st Choice	2 nd Choice
100:106	28	22	70	9	23
104	13	10	68	20	21
102	12	13	66	19	24
100	27	11	64	38	28
98	19	10	62 0	22	35
96	26	10	60	13	24
94	28	14	58	13	11
92	59	41	56	13	21
90	44	34	54	13	23
88	29	23	52	11	27
86	22	26	50	7	14
84	14	6	48	14	19
82	11	14	46	9	12
80	24	31	44	6	13
78	38	32	42	6	9
76	42	23	40	4	18
74	30	38	38	10	9
72	19	17	36	20	26

Failures to make 2nd Choice = 4

Table No. 2 Rectangles.

Classes not included by Table No. 3.-410.

Ratios.	1 st Choice	2 nd Choice	Ratios	1 st	2 nd
100:106	19	8	70	5	15
- 104	6	8	- 68	8	10
- 102	8	4	- 66	14	9
- 100	20	6	- 64	14	14
- 98	14	3	- 62 @	9	19
- 96	21	8	- 60	5	18
- 94	22	11	- 58	9	9
- 92	26	28	- 56	11	11
- 90	26	19	- 54	7	14
- 88	14	10	- 52	7	13
- 86	16	19	- 50	1	6
- 84	9	3	- 48	6	16
- 82	5	8	- 46	3	11
- 80	8	19	- 44	5	9
- 78	24	20	- 42	2	4
- 76	21	11	- 40	3	6
- 74	15	16	- 38	7	3
- 72	11	9	- 36	11	11

Failures to make 2nd choice = 2

Table No 3 Rectangles.

Paupers, House of Refuge, Indians. 321

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100:106	9	14	" 70	4	8
" 104	7	2	- 68	12	11
" 102	4	9	" 66	5	15
" 100	7	5	" 64	24	14
" 98	5	7	- 62 0	13	16
" 96	5	2	- 60	8	6
" 94	6	3	- 58	4	2
" 92	33	13	" 56	2	10
" 90	18	15	- 54	6	9
" 88	15	13	" 52	4	14
" 86	6	7	- 50	6	8
" 84	5	3	" 48	8	3
" 82	6	6	- 46	6	1
" 80	16	12	- 44	1	4
" 78	14	12	" 42	4	5
" 76	21	12	- 40	1	12
" 74	15	17	- 38	3	6
" 72	8	8	- 36	9	15

Failure to make 2nd Choice = 2

Table No. 4. Rectangles.

Males of classes not included of Table No. 6. 255.

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100: 106	8	2	" 70	4	9
" 104	3	5	" 68	5	8
" 102	6	3	" 66	11	6
" 100	7	2	" 64	13	10
" 98	5	2	" 62 0	5	12
" 96	9	7	" 60	3	9
" 94	15	4	" 58	5	6
" 92	12	14	" 56	8	10
" 90	14	11	" 54	3	12
" 88	9	7	" 52	6	10
" 86	11	9	" 50	0	6
" 84	7	0	" 48	6	12
" 82	4	6	" 46	3	5
" 80	7	13	" 44	2	2
" 78	18	13	" 42	1	3
" 76	16	9	" 40	1	0
" 74	9	14	" 38	3	1
" 72	6	8	" 36	10	6

Failure to make 2nd choice =

Table No. 5. Rectangles.

Females. Grammar School & Art Students. 155

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100:106	11	6	70	2	6
" 104	3	3	" 68	3	2
" 102	2	1	" 66	4	3
" 100	13	4	" 64	1	4
" 98	9	1	" 62 0	4	7
" 96	12	1	" 60	2	9
" 94	7	7	" 58	4	3
" 92	12	14	" 56	3	1
" 90	14	8	" 54	4	2
" 88	5	3	" 52	1	3
" 86	5	10	" 50	1	0
" 84	2	3	" 48	0	4
" 82	1	2	" 46	0	6
" 80	1	6	" 44	1	7
" 78	6	7	" 42	1	1
" 76	5	2	" 40	2	6
" 74	6	2	" 38	4	2
" 72	3	1	" 36	1	7

Failure to make 2nd choice = 1

Table No. 6. Rectangles.

Males. Paupers, House of R. Indians. 241

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100: 106	6	10	70	3	7
104	7	2	68	9	6
102	3	8	66	3	11
100	5	5	64	21	10
98	4	5	62 0	11	10
96	4	1	60	5	3
94	5	1	58	4	1
92	28	9	56	2	7
90	16	15	54	6	5
88	10	9	52	3	10
86	5	5	50	4	7
84	3	2	48	5	2
82	3	4	46	3	1
80	11	9	44	1	4
78	10	9	42	2	4
76	14	11	40	2	11
74	7	10	38	3	5
72	6	5	36	7	15

Failure to make 2nd choice = 2

Table No. 7 Rectangles.

Females. Paupers & Indians. 80

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100: 106	3	4	" 70	1	1
" 104	0	0	" 68	3	5
" 102	1	1	67		
" 100	2	0	" 66	2	4
" 98	1	2	" 64	3	4
" 96	1	1	" 62 0	2	6
" 94	1	2	" 60	3	3
" 92	5	4	" 58	0	1
" 90	2	0	" 56	0	3
" 88	5	4	" 54	0	4
" 86	1	2	" 52	1	4
" 84	2	1	" 50	2	1
" 82	3	2	" 48	3	1
" 80	5	3	" 46	3	0
" 78	4	3	" 44	0	0
" 76	7	1	" 42	2	1
" 74	8	7	" 40	0	1
" 72	2	3	" 38	0	1
			" 36	2	0

Table No. 8. Rectangles.

Professional Men. 10

Ratio	1 st	2 nd	Ratio	1 st	2 nd
100 ; 106	0	0	" 70	0	1
" 104	0	1	" 68	0	0
" 102	0	0	" 66	0	0
" 100	1	0	" 64	1	1
" 98	1	0	" 62 @	0	1
" 96	0	0	" 60	0	1
" 94	1	0	" 58	0	0
" 92	1	0	" 56	0	0
" 90	0	0	" 54	0	1
" 88	0	0	" 52	0	0
" 86	0	1	" 50	0	1
" 84	0	0	" 48	0	0
" 82	0	0	" 46	0	0
" 80	0	1	" 44	0	0
" 78	2	1	" 42	0	0
" 76	2	0	" 40	0	0
" 74	0	0	" 38	0	0
" 72	1	0	" 36	0	0

Table No. 9. Rectangles.

Males. Teachers & Post Graduates. 11

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100: 106	0	0	" 70	0	1
" 104	1	0	" 68	0	0
" 102	0	0	" 66	1	1
" 100	0	1	" 64	2	0
" 98	1	0	" 62 ①	1	0
" 96	1	0	" 60	0	0
" 94	0	0	" 58	0	0
" 92	0	1	" 56	1	0
" 90	0	0	" 54	0	0
" 88	0	0	" 52	0	0
" 86	1	1	" 50	0	0
" 84	0	0	" 48	0	1
" 82	0	0	" 46	0	1
" 80	0	0	" 44	0	0
" 78	1	0	" 42	0	0
" 76	1	2	" 40	0	0
" 74	0	2	" 38	0	0
" 72	0	0	" 36	0	0

Table No. 10 Rectangles.

Males - Undergraduates - h. of P. 83

Ratios	1st	2nd	Ratios	1st	2nd
100 : 106	1	1	" 70	1	3
" 104	1	1	" 68	3	4
" 102	1	0	" 66	3	3
" 100	0	1	" 64	6	3
" 98	1	1	" 62 @	3	8
" 96	2	3	" 60	0	0
" 94	4	2	" 58	1	2
" 92	1	7	" 56	4	1
" 90	6	4	" 54	1	4
" 88	3	2	" 52	3	2
" 86	5	2	" 50	0	2
" 84	2	0	" 48	2	2
" 82	2	1	" 46	1	1
" 80	2	4	" 44	1	0
" 78	6	7	" 42	0	0
" 76	6	4	" 40	1	0
" 74	7	2	" 38	0	0
" 72	2	3	" 36	1	2

Failure to make 2nd choice = 0

Table No. 11 Rectangles.

Males. Episcopal Academy. 58

Ratio	1st	2nd	Ratio	1st	2nd
100: 100	0	1	70	2	3
- 104	0	1	- 68	1	2
.. 102	1	3	- 66	5	0
.. 100	1	0	- 64	3	1
.. 98	1	0	.. 62 0	1	2
.. 96	1	1	.. 60	2	6
- 94	3	1	.. 58	1	0
.. 92	3	1	- 56	2	3
.. 90	3	5	.. 54	1	4
.. 88	0	0	- 52	1	2
- 86	0	1	.. 50	0	2
.. 84	5	0	.. 48	1	4
.. 82	1	1	- 46	1	2
.. 80	2	3	- 44	1	0
.. 78	4	3	- 42	1	1
.. 76	3	1	.. 40	0	0
.. 74	1	4	.. 38	0	0
.. 72	2	0	.. 36	4	0

Table No. 12 Rectangles.

Males. Art Students. 6.

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100:106	1	0	70	0	0
104	0	1	68	1	0
102	1	0	66	1	0
100	1	0	64	0	2
98	0	0	62	0	0
96	0	0	60	0	0
94	0	0	58	0	0
92	0	0	56	0	0
90	0	0	54	0	0
88	0	0	52	0	0
86	0	0	50	0	0
84	0	0	48	0	0
82	0	1	46	0	0
80	0	2	44	0	0
78	0	0	42	0	0
76	0	0	40	0	0
74	1	0	38	0	0
72	0	0	36	0	0

Table No. 13 Rectangles.

Males. Grammar School Pupils. 87

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100 : 100	6	0	70	1	1
104	1	1	68	0	2
102	3	0	66	1	2
100	4	0	64	1	3
98	1	1	62 0	0	1
96	5	3	60	1	2
94	7	1	58	3	4
92	7	5	56	1	6
90	5	2	54	1	3
88	6	5	52	2	6
86	5	4	50	0	1
84	0	0	48	3	5
82	1	3	46	1	1
80	3	3	44	0	2
78	5	2	42	0	2
76	4	2	40	0	0
74	0	6	38	3	1
72	1	5	36	5	2

Table No. 14 Rectangles.

Females. Ant Students. 7.

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100: 100	0	0	70	0	1
" 104	0	0	68	0	1
" 102	0	0	66	1	0
" 100	0	0	64	1	0
" 98	0	0	62	0	0
" 96	0	0	60	0	1
" 94	0	0	58	1	1
" 92	1	0	56	0	0
" 90	0	0	54	0	0
" 88	1	0	52	0	0
" 86	1	0	50	0	0
" 84	0	0	48	0	0
" 82	0	0	46	0	0
" 80	0	1	44	0	0
" 78	0	1	42	0	0
" 76	1	0	40	0	0
" 74	0	1	38	0	0
" 72	0	0	36	0	0

Table No. 15 Rectangles.

Females. Grammar School Pupils. 148

Ratio	1 st	2 nd	Ratio	1 st	2 nd
100: 106	11	6	" 70	2	5
" 104	3	3	" 68	3	1
" 102	2	1	" 66	3	3
" 100	13	4	" 64	0	4
" 98	9	1	" 62 0	4	7
" 96	12	1	" 60	2	8
" 94	7	7	" 58	3	2
" 92	11	14	" 56	3	1
" 90	14	8	" 54	4	2
" 88	4	3	" 52	1	3
" 86	4	10	" 50	1	0
" 84	2	3	" 48	0	4
" 82	1	2	" 46	0	6
" 80	1	5	" 44	1	7
" 78	6	6	" 42	1	1
" 76	4	2	" 40	2	6
" 74	6	1	" 38	4	2
" 72	3	1	" 36	1	7

Failure to make 2nd Choice = 0

Table No. 16 Rectangles.

Males. Carlisle School Division. 37

Ratio	1st	2nd	Ratio	1st	2nd
100: 106	1	2	70	0	1
" 104	0	0	68	0	1
" 102	1	1	66	0	1
" 100	1	0	64	3	3
" 98	1	2	62 0	1	0
" 96	2	0	60	1	2
" 94	1	0	58	2	0
" 92	2	1	56	0	4
" 90	2	0	54	1	1
" 88	2	0	52	1	1
" 86	0	1	50	0	0
" 84	2	1	48	2	1
" 82	2	1	46	1	0
" 80	2	2	44	0	1
" 78	1	1	42	0	1
" 76	2	1	40	0	0
" 74	0	1	38	1	2
" 72	1	2	36	1	2

Table No. 17 Rectangles.

Males. Almostous Pampin. 30.

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100 : 106	0	0	" 70	0	1
" 104	0	0	" 68	0	2
" 102	1	0	" 66	0	1
" 100	1	0	" 64	2	1
" 98	0	1	" 62 0	0	1
" 96	1	0	" 60	1	2
" 94	0	0	" 58	1	0
" 92	0	0	" 56	2	1
" 90	2	2	" 54	1	0
" 88	1	2	" 52	1	1
" 86	0	0	" 50	2	2
" 84	0	1	" 48	2	0
" 82	0	1	" 46	0	0
" 80	2	1	" 44	0	1
" 78	2	0	" 42	1	0
" 76	4	2	" 40	0	2
" 74	1	1	" 38	0	1
" 72	1	1	" 36	1	0

Failures to make 2nd choice = 2

Table No. 18. Rectangles.

Males, House of Refuge. 174

Ratio	1 st	2 nd	Ratio	1 st	2 nd
100:106	5	8	70	3	5
104	7	2	68	9	3
102	1	7	66	3	7
100	3	5	64	16	6
98	3	2	620	10	4
96	1	1	60	3	1
94	4	1	58	1	1
92	26	8	56	0	2
90	12	13	54	4	4
88	7	7	52	1	8
86	5	4	50	2	5
84	1	0	48	1	1
82	1	2	46	2	1
80	7	6	44	1	2
78	7	8	42	1	3
76	8	8	40	2	4
74	6	8	38	2	2
72	4	2	36	5	13

Table No. 19. Rectangles.

Females. Caribbee School Indians. 34

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100 : 106	1	1	" 70	1	1
" 104	0	0	" 68	2	4
" 102	0	1	" 66	1	0
" 100	0	0	" 64	0	0
" 98	1	1	" 62	1	0
" 96	0	1	" 60 0	2	2
" 94	1	2	" 58	0	1
" 92	1	2	" 56	0	0
" 90	2	0	" 54	0	0
" 88	1	3	" 52	1	1
" 86	0	1	" 50	1	0
" 84	2	1	" 48	2	0
" 82	2	2	" 46	1	0
" 80	4	2	" 44	0	0
" 78	2	2	" 42	0	0
" 76	1	0	" 40	0	0
" 74	3	2	" 38	0	1
" 72	0	3	" 36	1	0

Table No 20 Rectangles.

Females. Almshouse Paupers. 46.

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100 : 106	2	3	70	0	0
" 104	0	0	68	1	1
" 102	1	0	66	1	4
" 100	2	0	64	3	4
" 98	0	1	62 ①	1	6
" 96	1	0	60	1	1
" 94	0	0	58	0	0
" 92	4	2	56	0	3
" 90	0	0	54	0	4
" 88	4	1	52	0	3
" 86	1	1	50	1	1
" 84	0	0	48	1	1
" 82	1	0	46	2	0
" 80	1	1	44	0	0
" 78	2	1	42	2	1
" 76	0	1	40	0	1
" 74	5	5	38	0	0
" 72	2	0	36	1	0

Table No. 21 Rectangles.
Males. All classes. 496

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100: 106	14	12	" 70	6	16
" 104	10	7	" 68	14	14
" 102	9	11	" 66	13	17
" 100	12	7	" 64	34	20
" 98	9	7	" 62 0	16	22
" 96	13	8	" 60	8	12
" 94	20	5	" 58	9	7
" 92	42	23	" 56	10	17
" 90	28	26	" 54	9	17
" 88	19	16	" 52	9	20
" 86	16	14	" 50	4	13
" 84	10	2	" 48	11	14
" 82	7	10	" 46	6	6
" 80	18	22	" 44	5	6
" 78	28	22	" 42	3	7
" 76	30	20	" 40	2	11
" 74	16	24	" 38	6	6
" 72	14	13	" 36	17	19

Failures to make 2nd choice = 3

Table No. 22 Rectangles.

Females. All Classes, 235

Ratio	1 st	2 nd	Ratio	1 st	2 nd
100: 106	14	10	" 70	3	7
" 104	3	3	" 68	6	7
" 102	3	2	" 66	6	7
" 100	15	4	" 64	4	8
" 98	10	3	" 62 0	6	13
" 96	13	2	" 60	5	12
" 94	8	9	" 58	4	4
" 92	17	18	" 56	3	4
" 90	16	8	" 54	4	6
" 88	10	7	" 52	2	7
" 86	6	12	" 50	3	1
" 84	4	4	" 48	3	5
" 82	4	4	" 46	3	6
" 80	6	9	" 44	1	7
" 78	10	10	" 42	3	2
" 76	12	3	" 40	2	7
" 74	14	9	" 38	4	3
" 72	5	4	" 36	3	7

Failure to make 2nd choice = 1

LIBRARY
JUL 19 1908

Considering first the bearing of the preceding tables on the results of Fechner. From Table No.I. it becomes evident that, as has already been surmised, the conclusion that the square and the figures lying near it are among the least pleasing is to be attributed to the fact that Fechner made no allowance for the physiological over-estimation of the vertical height of a rectangular figure. It will be seen that the total number of choices falling on the ratio 100:92 is by far greater than on any other in the entire series. But (as may be seen by simple trial with the reproduced rectangles of the Appendix) it is this very figure which, held in the vertical plane, looks as if it were the square, the real square looking much too high. The next greatest number of choices falls on the next smaller figure, which no doubt would to many persons look more nearly square than the preceding. 100:92 also received the greatest number of second choices showing that even among those who did not prefer the square above all other figures, there were many who placed it only after their first choice. It will ^{further} ~~also~~ be noticed that with both the educated and uneducated (Tables 2,3) the square has a considerable advantage over other shapes. So far then from being an unpleasing figure, the square is of all the most generally pleasing.

The second part of Fechner's conclusion, that the very long figures are unpleasing is in full accord with the present results. At first sight it might seem as if the last figure were an exception, but it is more reasonable to suppose that the considerable increase to twenty choices which Table I. shows, is rather due to the position of the figure at the extreme end of a long series, there being a physiological advantage in such a figure owing to the fact that the eye experiences a certain agreeable sense of rest in not being obliged to hurry on to compare some other ratio.

Fechner's second conclusion that the square has little advantage over the figures near it is no doubt true of the real square and of the subjective square is true as far as perhaps one figure on either side, this variation being due, however, merely to the differing perceptions of the subject, which leads to objective difference in the figure picked out as the square.

In comparing the principal musical ratios (which are taken approximately as follows: octave = 50:100; fifth = 66:100; fourth = 74:100 major third = 80:100; minor third = 84:100) we shall see from Table No. I., bearing in mind that the figure selected will really be from two to four figures - according to its actual size - lower than the

subject imagines, that the octave is one of the least pleasing shapes. The fifth, 66, is more popular, nearly the average number of choices (20) falling on it. The fourth, 74, is about as pleasing as the fifth, but the major third, 30, receives choices considerably above the average. From 30 upwards the curve of pleasingness rises to the maximum for sizes other than the square until 8a or 84. The advantage ~~of~~ of the figures representing the intervals of the major and minor third is from the general tendency of the whole table quite as easily to be explained by being a mean between the evidently displeasing long figures on the one hand and those figures on the other hand which from being but slightly removed from the square give the effect of badly drawn squares. It seems then an unwarranted assumption that the common musical intervals represent especially pleasing proportions. If such a connection existed, we would expect to find it more operative in the educated classes than with such persons as the paupers of the Philadelphia Alms House or Indians, but in comparing the respective tables it will be seen that this is not the case. Fechner's third conclusion is then in accordance with the present results.

The Harmonic Mean is almost exactly represented by the 100:62, and it is evident that this is by no means one of the most pleasing

proportions. Taking 58 to be the figure which will appear ~~of~~^{the} proportions of the figure really 62, out of 731 choices this figure received only 13, so that we must abandon any claim for superior merit of Zeising's Golden Section.. It cannot be claimed that the reason for this is that persons of probably inferior taste form a large proportion of the subjects, for when we examine Tables 8, 9, 10, we see that this figure still remains almost without choices, while out of thirteen Art students only one selected it.

Having now seen the conclusions which we are not justified in drawing, we pass on to those which do seem to be supported by the facts. In the first place, there can be no doubt that ^{to} the majority of my subjects out of such a series of simple rectangles the square was more pleasing than any other proportion. The next most pleasing shape has the subjective value about 82:100 (really 76 or 73). The relative value of these two figures varies somewhat with the class; thus in Table 2. taking the choices falling on 92, 90, 88 as representing the number of persons who thought they were picking out the square, we find that the square received 13.0% of the total choices, while ⁷⁸~~24~~, ⁷⁶~~81~~, ⁷⁴~~15~~ received 14.6%, a difference in favor of the square of 3.4%. In Table 3. on the contrary, the percentages are respectively 17.7

and 17.1, a difference of only 0.6% in favor of the square.

In table 4. the ratio 82 has a slight advantage over the square, the former receiving 41 choices while the latter received 43. In Table 7. this condition is more marked, which contradicts the *common* supposition that an uncultivated mind would prefer the simply symmetry of the ratio 1:1 rather than the more complicated relation. Tables 8,9,10, the choices of persons of cultivation, all agree in giving the *more* complicated ratio the preference over the square. Enquiring how these facts are compatible with the results summed up in tables 2 and 3, we find that the advantage of the square over the ratio 82 as shown in Table 2, is to be attributed entirely to the pupils of the two schools so largely represented,- The Episcopal Academy and Hart Grammar School; while in the case of Table 3., it is the boys of the House of Refuge who are responsible for the like favorable position of the square. This leads to the conclusion that the young prefer the square to all other figures, while adults of nearly all classes prefer some other ratio, usually 82:100, the square coming next or sometimes next but one after this ratio. In order to show this clearly the following tables are introduced:-

Table A.

Adults of both sexes. 264.

Tables Nos.	8	9	10	12	14	16	17	19	20	TOTAL CHOICES
Choices fall- ing on 94,92 and 90 (100: 100)	2	0	11	0	1	5	2	4	4	29=10.9%
Choices fall- ing on 78,76 and 74 (100:82)	4	2	19	1	1	3	7	6	13	56=21.2%

Table B.

Boys and Girls, 467.

Tables Nos.	11	13	15	18	TOTAL CHOICES
Choices fall- ing on 94,92 and 90 (100:100)	9	19	32	42	102=21.8%
Choices fall- ing on 78,76 and 74 (100:82)	8	9	16	21	54=11.5%

In Table II the proportion 72 received as many choices as the square, being thus superior to 82, while in Table 18 the proportion

72 also received more than 32, though still considerably less than the square. These facts, however, do not detract from the truth of the statement that while the square is not with adults the most pleasing figure, it does, in general, hold this position for children. We must suppose, then, that the pleasingness of squares is due to some inborn or physiological condition, which later becomes modified or superseded as the result of the manifold associations of later life. Since in the case of the male Indians, Table I6, the square is inferior to the ratio 92; with the male paupers, Table I7, to the ratio 84; with the female Indians to the ratio 86; with the female paupers to 32, it is difficult to believe that this modifying process of later life has anything to do with the culture of the mind in its narrower sense, and one is disposed to conclude that the effective associations are simply those of common life which every being necessarily forms. The following is a possible explanation. Originally a square figure is preferred, but little by little the idea of strength, permanence, and safety become rooted in the mind. In proportion to the unconscious growth of directing influence of these ideas, a square figure will become one without marked tendency to definite placement, without a substantial base upon which to rest

more securely than in any other position. In looking along the series of figures the eye soon comes to one distinctly longer than high, that is, one which has a definite tendency to remain firmly in a particular position, from which considerable force would be necessary to overturn it. Passing on, the stability of the figures becomes greater, but at the same time the violation of the inherent love of symmetry becomes more distasteful to the subject. The point at which these two opposed mental forces balance is the determining moment of the selection of the figure. This explanation has carried us somewhat far, it is true, from the original conception of the figures as simple planes without association of any kind, yet there seems to be no certainty that this condition can ever in practice be reached, and in a number of subjects whom I questioned, there was every reason to believe that associations of a far less delicate nature were allowed to influence their decisions.

But ^{besides} ~~the size~~ of the two ratios already discussed there is another which in pleasingness closely follows them, - the subjective ratio 100:70, represented by 66, 64, 62. From Tables 21, and 22, we find that it is only to males that this ratio is pleasing, while among males it is much more pleasing to the uneducated than to the educated

(see Tables 4 and 6). Again, comparing Tables 16, 17, 18 it appears that the special pleasingness is confined principally to the boys of the House of Refuge. On the contrary, out of 87 boys of the Grammar School only two gave it first choice. The significance of this third pleasing ratio is not evident but might perhaps be associated with a greater sense of freedom and lack of conventional restraint in discarding the squarer figures in favor of one whose proportions are more strikingly different, such a feeling having supposedly a considerable place with young criminals. The falling of the first choice on a very long figure would usually be prevented by the intrinsically displeasing character of such figures, yet it is interesting to note that while on the longest figures, say those of the last horizontal line 46 to 36, the total males except those of the House of Refuge (Table 21, Table 18) gave these extreme figures an aggregate of second choice of only 7.7%, the percentage for the same figures in the case of the House of Refuge amounted to no less than 17.2%.

Of the second choices in general but little has been said. They sum themselves largely into a succession of maxima and minima determined in accordance with the middles and extremities of the horizontal lines. Thus the objection of the "Influence of the Middle",

of small moment as long as there is a marked advantage of one figure over another, ~~thus~~ becomes a disturbing factor of real importance in the selection of the most pleasing of a number of figures of nearly equal value.

Table No. 1. Crosses.

Total Choices on Crosses. 550

Ration	1 st choice	2 nd choice	Ration	1 st	2 nd
75: 75	83	23	" 51	8	16
75: 73	56	31	" 49	13	24
" 71	53	24	" 47 0	13	13
" 69	40	22	" 45	17	21
" 67	24	17	" 43	11	22
" 65	42	26	" 41	8	17
" 63	15	38	" 39	11	21
" 61	16	35	" 37	8	15
" 59	37	42	" 35	7	11
" 57	27	38	" 33	12	16
" 55	20	17	" 31	8	16
" 53	7	17	" 29	14	21

Failure to make 2nd choice = 7

Table No. 2. Crosses.

Educated Classes = Table 1 - Table 3. 410.

Ratios	1 st	2 nd	Ratios	1 st	2 nd
75:75	72	19	" 51	8	13
" 73	43	29	" 49	9	17
" 71	46	17	" 47	10	9
" 69	26	21	" 45	9	16
" 67	16	16	" 43	4	15
" 65	37	21	" 41	7	13
" 63	10	25	" 39	5	14
" 61	13	24	" 37	2	7
" 59	30	30	" 35	3	6
" 57	13	26	" 33	9	12
" 55	14	11	" 31	6	13
" 53	5	14	" 29	13	18

Failures to make 2nd Choice = 4

Table No. 3(4,6). Crosses.

Males. Uneducated = House of Refuge. 140

Ration	1 st	2 nd	Ration	1 st	2 nd
75 : 75	11	4	51	0	3
73	13	2	49	4	7
71	7	7	47 0	3	4
69	14	1	45	8	5
67	8	1	43	7	7
65	5	5	41	1	4
63	5	13	39	6	7
61	3	11	37	6	8
59	7	12	35	4	5
57	14	12	33	3	4
55	6	6	31	2	3
53	2	3	29	1	3

Failure to make 2nd choice = 3

Table No 4 Crosses.

Total Males of Educated Classes. 255

Ratios	1 st	2 nd	Ratios	1 st	2 nd
75 : 75	38	13	- 51	5	10
- 73	18	15	- 49	7	13
- 71	31	10	- 47 ⁰	7	5
- 69	20	13	- 45	8	14
- 67	10	9	- 43	4	9
- 65	22	14	- 41	6	8
- 63	3	14	- 39	3	12
- 61	6	13	- 37	2	6
- 59	22	17	- 35	3	3
- 57	9	17	- 33	7	7
- 55	9	8	- 31	4	5
- 53	5	8	- 29	6	11

Failure to make 2nd class = 1

Table No. 5 Crosses.

Total Females. 155

Ratio	1 st	2 nd	Ratio	1 st	2 nd
75 : 75	34	6	• 51	3	3
" 73	25	14	• 49	2	4
" 71	15	7	• 47 ①	3	4
" 69	6	8	• 45	1	2
" 67	6	7	• 43	0	6
" 65	15	7	• 41	1	5
" 63	7	11	• 39	2	2
" 61	7	11	• 37	0	1
" 59	8	13	• 35	0	3
" 57	4	9	• 33	2	5
" 55	5	3	• 31	2	8
" 53	0	6	• 29	7	7

Failures to make 2nd Choice = 3

Since for the reasons already given, the experiments with the crosses and lines are less complete than those of the rectangles, summaries only of the results are given. The first three ^{crosses} ~~figures~~, especially the first, are the evident favorites, while another maximum is reached in the ratio of 75:65. Since in each of the tables except that of the House of Refuge this second maximum is preserved, despite the fact that the figure is one at the end of the line, there is doubtless some strong reason why it should be selected, and it is possible that the combat of symmetry and stability mentioned in connection with the rectangle is also the cause of the general selection of this particular cross.

In Table 3 we ~~also~~ see the same tendency for the second maximum to move to a lower position in the series, viz., 57, which presents a greater contrast. It will also be noticed that in this table only is the ratio 69, which has the subjective value of the symmetrical cross chosen as the first maximum. The other maxima seem to be dependent on the "Influence of the Middle", a probable result of the relatively small difference of aesthetic value of one cross over another. The Harmonic Mean, 47, always is weaker than most of the other maxima due to middle, so that here, as in the case of the rectangle, there is no reason to suppose that it enjoys any advantage over other ratios.

Table No. 1. Lines.

Total Choices on Lines - 550

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100 : 100	216	43	148 : 52	10	16
102 : 98	79	76	150 : 50	10	9
104 : 96	14	43	152 : 48	9	11
106 : 94	15	31	154 : 46	2	17
108 : 92	8	11	156 : 44	2	7
110 : 90	11	17	158 : 42	1	16
112 : 88	2	7	160 : 40	5	12
114 : 86	15	7	162 : 38	2	4
116 : 84	2	4	164 : 36	7	7
118 : 82	2	10	166 : 34	2	11
120 : 80	4	6	168 : 32	5	8
122 : 78	8	8	170 : 30	3	5
124 : 76	1	4	172 : 28	1	6
126 : 74	8	1	174 : 26	3	6
128 : 72	3	5	176 : 24	3	4
130 : 70	8	5	178 : 22	3	6
132 : 68	1	3	180 : 20	2	0
134 : 66	1	1	182 : 18	3	2
136 : 64	4	4	184 : 16	3	6
138 : 62	3	3	186 : 14	3	5
140 : 60	3	5	188 : 12	5	5
142 : 58	5	4	190 : 10	2	6
144 : 56	14	14	192 : 8	9	10

Failures to make 2nd choice = 10

Table No. 2 Lines.

Educated Classes. 410.

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100 : 100	192	36	148 : 52	6	12
102 : 98	63	66	150 : 50	9	7
104 : 96	12	39	152 : 48	7	9
106 : 94	9	23	154 : 46	0	15
108 : 92	5	7	156 : 44	2	5
110 : 90	7	9	158 : 42	0	8
112 : 88	1	4	160 : 40	4	6
114 : 86	7	3	162 : 38	0	4
116 : 84	0	1	164 : 36	4	5
118 : 82	1	7	166 : 34	1	5
120 : 80	3	5	168 : 32	4	6
122 : 78	5	7	170 : 30	1	0
124 : 76	0	2	172 : 28	1	3
126 : 74	2	0	174 : 26	2	5
128 : 72	2	5	176 : 24	1	0
130 : 70	5	4	178 : 22	2	4
132 : 68	1	3	180 : 20	1	0
134 : 66	1	1	182 : 18	1	0
136 : 64	4	4	184 : 16	2	4
138 : 62	2	3	186 : 14	3	1.
140 : 60	3	5	188 : 12	3	4
142 : 58	5	3	190 : 10	2	4
144 : 56	10	14	192 : 8	4	7
146 : 54	2	1			0

Table No. 3. Lines

Males Uneducated: House of Refuge. 140

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100:100	24	7	148:52	4	4
102:98	16	11	150:50	1	2
104:96	2	4	152:48	2	2
106:94	6	8	154:46	2	2
108:92	3	4	156:44	0	2
110:90	4	8	158:42	1	8
112:88	1	3	160:40	1	6
114:86	8	4	162:38	2	0
116:84	2	3	164:36	3	2
118:82	1	3	166:34	1	6
120:80	1	1	168:32	1	2
122:78	3	1	170:30	2	5
124:76 ©	1	2	172:28	0	3
126:74	6	1	174:26	1	1
128:72	1	0	176:24	2	4
130:70	3	1	178:22	1	2
132:68	0	0	180:20	1	0
134:66	0	0	182:18	2	2
136:64	0	0	184:16	1	2
138:62	1	0	186:14	0	4
140:60	0	0	188:12	2	1
142:58	0	1	190:10	0	2
144:56	4	0	192:8	5	3

Table No. 4 Lines.

Total Males of Educated Classes. 255.

Ratio	1 st	2 nd	Ratio	1 st	2 nd
100 : 100	127	24	148 : 52	4	7
102 : 98	30	48	150 : 50	5	2
104 : 96	5	19	152 : 48	3	6
106 : 94	6	15	154 : 46	0	5
108 : 92	3	2	156 : 44	1	2
110 : 90	4	2	158 : 42	0	6
112 : 88	0	0	160 : 40	3	3
114 : 86	5	3	162 : 38	0	3
116 : 84	0	1	164 : 36	4	3
118 : 82	0	5	166 : 34	1	4
120 : 80	2	4	168 : 32	4	3
122 : 78	4	4	170 : 30	0	0
124 : 76	0	2	172 : 28	1	2
126 : 74	1	0	174 : 26	1	4
128 : 72	2	5	176 : 24	1	0
130 : 70	4	4	178 : 22	2	2
132 : 68	1	2	180 : 20	1	0
134 : 66	1	1	182 : 18	0	0
136 : 64	1	1	184 : 16	1	3
138 : 62	2	2	186 : 14	3	1
140 : 60	3	4	188 : 12	2	2
142 : 58	4	0	190 : 10	2	2
144 : 56	5	11	192 : 8	2	5

Failure to make 2nd choice = 5

Table No. 5 Lines

Total Females 155

Ratios	1 st	2 nd	Ratios	1 st	2 nd
100:110	65	12	148:52	2	5
102:98	33	18	150:50	4	5
104:96	7	20	152:48	4	3
106:94	3	8	154:46	0	10
108:92	2	5	156:44	1	3
110:90	3	7	158:42	0	2
112:88	1	4	160:40	1	3
114:86	2	0	162:38	0	1
116:84	0	0	164:36	0	2
118:82	1	2	166:34	0	1
120:80	1	1	168:32	0	3
122:78	1	3	170:30	1	0
124:76	0	0	172:28	0	1
126:74	1	0	174:26	1	1
128:72	0	0	176:24	0	0
130:70	1	0	178:22	0	2
132:68	0	1	180:20	0	0
134:66	0	0	182:18	1	0
136:64	3	3	184:16	1	1
138:62	0	1	186:14	0	0
140:60	0	1	188:12	1	2
142:58	1	3	190:10	0	2
144:56	5	3	192:8	2	2

Failures to make 2nd choice = 5

The results with the lines abundantly support Fechner's statement that the most pleasing division of horizontal lines is the symmetrical. So thoroughly indeed are the choices rassed on the first four figures that it seems almost hopeless to find any other pleasing division at all. It appears, however, that the figures from 56 to 50 have a slight preference over the rest, which is marked by some increase of both first and second choices on the figures named. While in the experiments at the House of Refuge the great pleasingness of the regular division is very apparent, yet it is also to be observed that the proportion of choices distributed along the remainder of the series is considerably greater than in the case of the males of the better classes (Table 4), the first choices on the first four figures in Table 3 aggregating but 34.2%, while the same choices in Table 4 represent 65.8%, so that the symmetrical division is only about half as pleasing to the former class as to the latter. In so far the House of Refuge results agree throughout all three of the series of figures. With the lines, as in the other series, the Harmonic Mean shows no advantage..

Summing up the conclusions to which these experiments lead us, we find:-

1. Taking the experiments as whole, the square is the most pleasing of all rectangles. The next most generally pleasing shape is 82:100, represented objectively by 76-78 : 100.

2. Proceeding more in detail, we find that the young greatly prefer the square, while adults of nearly all classes prefer a less simple ratio, usually 82:100, which difference is probably to be explained by an early physiological tendency being finally overcome by the results of more mature experience.

3. The young of the criminal class prefer for second choice a figure whose sides present a greater contrast than is preferred by young or adults of other classes, in explanation of which is suggested the great sense of freedom ^{from} ~~and~~ conventional restraint associated with figures of such proportions.

4. Very ^{long} ~~low~~ rectangles are usually displeasing.

5. Contrary to the natural supposition, the effects of general culture are of small importance in determining the pleasingness of simple figures, while age plays a prominent rôle.

6. Figures the ratios between whose sides also represent the

ratios of the principal musical intervals are not preferable to those ratios which produce musical dissonance.

7. The rectangle representing the Harmonic Mean is preferred by no class.

8. Of the crosses, those most often selected are the first three notwithstanding that in at least the first two of these the vertical looks higher than the horizontal.

9. A second maximum is noted in the ratio 75:65 which reminds us of the explanation offered for the selection of the ratio 82:100.

10. The somewhat incomplete experiments at the House of Correction show that the figure whose subjective value is that of the square is chosen before all others, while ~~the~~ next in pleasingness to it comes a figure the contrast of whose dimensions is greater than that generally preferred by the other classes to whom the crosses were shown.

11. The Harmonic Mean is not a favorite ratio.

12. Of the lines, by far the most pleasing division is into equal parts. This is true of all classes, but the results from the House of Refuge show that the relative number of choices distributed over

the figures divided in such a way as to present considerable contrast of the two parts is greater than in the case of other classes.

I3. The division representing the Harmonic Mean is not distinguished by a superior pleasingness.

Before closing I desire to acknowledge my indebtedness to Dr. Lightner Witner, of the University of Pennsylvania, for a number of valuable suggestions in regard to the method of conducting these experiments. I am also under great obligation to the following gentlemen: Mr. Charles Lawrence, Superintendent, and Dr. Joseph Sailer, at the time of my experiments Resident Physician of the Philadelphia Hospital; Capt. R. H. Pratt, U.S.A., of the Government Indian School at Carlisle; Mr. Wm. H. Samuel, Principal of the Hart Grammar School; Mr. F. H. Nibecker, of the House of Refuge, Glen Mills; Dr. Wm. H. Clapp, of the Episcopal Academy; and Dr. George McClellan, of the Pennsylvania Academy of Fine Arts. They have not only offered me every facility for experimentation, but ~~by~~ their personal courtesy made my visits, in several cases repeated, to their respective in-

stitutions the most agreeable part of my work. Professor Fullerton also kindly placed at my disposal a considerable number of his students, both post graduates, and of the senior and junior classes. To all of these I desire to return my sincere thanks.

Carfax W. Miller

May, 1893.

-:- APPENDIX. -:-

Description of the Figures used in the Experiments.

In all three series,-

All lines drawn in black drawing ink on white paper.

All lines 4 mm. in width.

Some slight irregularities in the lines will be noticed in the reproductions. These are the results of the rather indifferent photographic work in copying, the figures themselves having been drawn with considerable care.

As will be seen the reproductions are not on the same scale.

Series I.

Rectangles. 36 Figures.

Throughout the series the base remains constantly 100 mm.

The height varies 2 mm. between each figure, and is expressed by the number placed inside. These numbers were of course absent in the originals.

The measurements are given to the outside of the bounding line.

1000.

106

104

102

100

98

96

94

92

90

88

86

84

82

80

78

76

74

72

70

68

66

64

62

60

58

56

54

52

50

48

46

44

42

40

38

36

Series II.

Crosses (axes of ellipses). 24 Figures.

Throughout the series the horizontal line remains 150 mm., while the number placed at each figure expresses the length of the lower part of the vertical. As will be seen, in each successive figure this line becomes shorter by 2 mm.

From the physiological tendency to overestimate the right part of a divided line, it was necessary to make the vertical to the right of the middle of the horizontal line, the amount of the correction, determined empirically, being about 1.5 mm. When this correction was not made the effect was to make the figure look ill-drawn, yet it was not easy for the subject to say to which side the vertical ought to be moved. Since the upper part of the vertical line is also overestimated, it was necessary to make this by 1.5 to 2.5 mm. shorter than the lower part.

Job.

75

73

71

69

67

65

58

55

57

59

61

63

51

49

47

45

43

41

29

31

33

35

37

39

Series III.

Line divided by a point. 48 Figures.

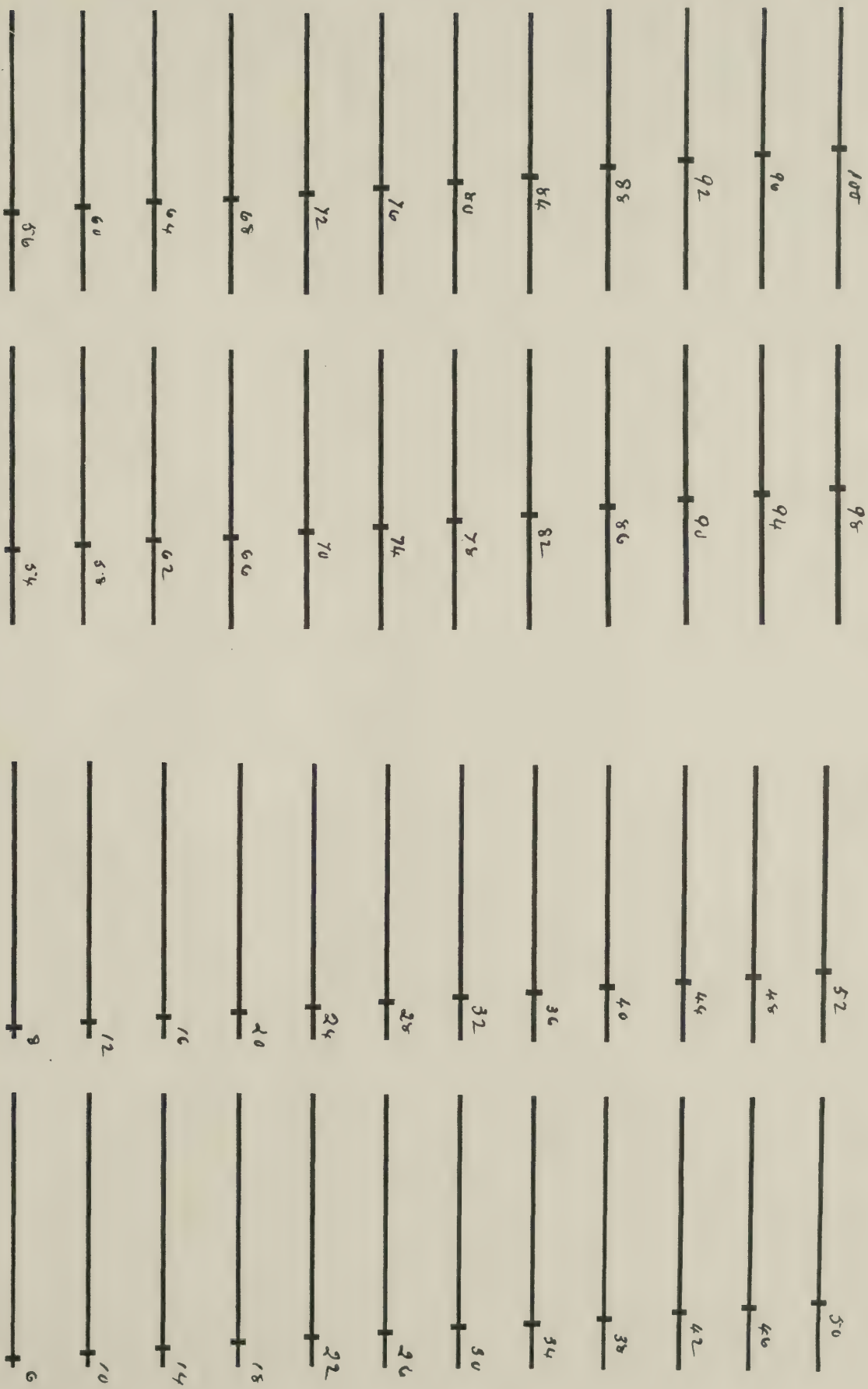
The line remains constantly 200 mm. long.

The cross-mark extends 4 mm. on either side of the line.

The respective distances measured from the centre of the point to the right end of the line, are given by the numbers.

It was found that the point could not be placed nearer the end end of the line than 6 mm. without giving at a little distance the effect of being quite at the end, when we would have had not a divided line at all but rather a line with a point at the end of it.

74p.



THE Object of these Experiments

is to ascertain whether there is any general agreement as to which figures in each of the three sets shown appear to be the most pleasing. It is desired to test this question particularly among those who have not interested themselves in Art.

If possible, no association (as of the *use* to which a particular figure could be put, etc.) should be allowed to determine your choice, but the figures should be looked at as a *series of figures only*, from which you are asked to choose the seemingly most pleasing.

Please State :—

Sex,

Age,

Profession or Business,

Are you specially interested in Art?

Have you ever taken lessons in Drawing?

(Do not write anything on this page below.)

Series 2 { Choice,
Alternate,

Series 3 { Choice,
Alternate,

Please indicate on this page the figures which you find the most pleasing.

FIRST SET OF FIGURES. SQUARES.

Which do you like best? (Indicate the figure by its number counted respectively from the *top* and *left side* as below).

No. of the figure chosen from top

No. of the figure chosen from left side

Which do you like next best?

No. of the figure chosen from top

No. of the figure chosen from left side

SECOND SET OF FIGURES. CROSSES.

Which do you like best?

No. of the figure chosen from top

No. of the figure chosen from left side

Which do you like next best?

No. of the figure chosen from top

No. of the figure chosen from left side

THIRD SET OF FIGURES. Lines divided into parts of different lengths.

Which do you like best?

No. of the line chosen from top

No. of the line chosen from left side

Which do you like next best?

No. of the line chosen from top

No. of the line chosen from left side

3 1198 02651 5648



N/1198/02651/5648X

3 1198 02651 5648



N/1198/02651/5648X

TOP